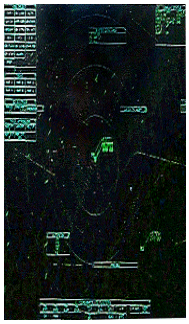
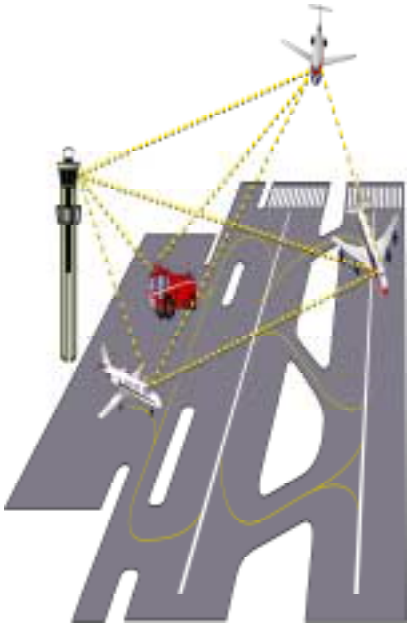
AD-6: Coordinate for Efficient Surface Movement

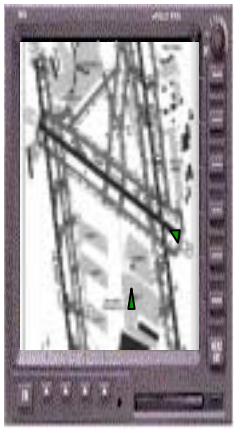
Improved planning, movement, and decision-making due to shared situational awareness of surface operations.



Enhanced ATC Airport Surface Surveillance

Final Approach & Runway Occupancy Awareness





Airport Surface Situational Awareness

Background

Tower controllers have limited information on the position of aircraft on the surface. Pilots have no electronic display of aircraft or ground vehicle position, velocity, or intent information. In addition, the ramp controllers, airport operators, and fixed-base operators have limited information on the location of aircraft on the surface. This lack of shared situational awareness results in inefficiencies in surface movement, gate management, and servicing of aircraft. Uncertainties in surface movement contribute to inefficient use of runways and have safety implications.

Ops Change Description

Distribution of position information on aircraft and selected ground vehicles can improve air traffic control, command and control, and services coordination on the surface.

- Improved traffic flow on the surface will result from improved decision-making supported by new procedures and decision-support tools. The information available includes real-time position data and data link of key events such as push-back and taxi clearance. Aeronautical data link of taxi clearances will reduce required voice communication and provide direct feed of this information into decision-support tools for runway load balancing and departure runway sequencing, better utilizing available

runway capacity and reducing taxi times. Data link of taxi clearances will also provide more reliability in execution and agreement of the clearance between pilot and controller. Reduction in voice communication requirements will allow the controller to spend more time working aircraft separation and efficient movement on the surface.

- Shared situational awareness for personnel responsible for flight scheduling, servicing, piloting, ramp and ground control will be achieved through the same set of real-time position information on an airport surface display for all flights and other ground vehicles currently on the airport surface. The shared situational awareness will also benefit air traffic ground control. For example, at airports where a ramp area is not under air traffic control and is not fully visible from the Air Traffic Control Tower (ATCT), the real-time position of all aircraft taxiing to the ramp exit from their gate will be shown to the ground controller (so that the runway sequence of each flight can be considered the flight request for taxi clearance).

Benefits, Performance and Metrics

- Departure throughput rates should increase and average taxi-out times decrease due to better sequencing and load balancing in departure queues.
- Airport surface safety will be improved through increased situational awareness resulting in safer operations on the airport surface.
- Improved communications and coordination will occur between:
  - Gate personnel
  - Ramp personnel
  - Airline Operation Centers (AOC)
  - Fixed-Base Operators
  - Airport Management, Security, Crash-Fire Rescue, and Maintenance personnel
  - Tower and Terminal Radar Approach Control (TRACON) air traffic control and air traffic management personnel

Scope and Applicability

- ADS-B Safety Assessment will be completed September 2001.
- The Surface Management System (SMS) provides tools to manage departure operations, including runway queuing and load balancing.
- The use of SMS in conjunction with other technologies will increase shared situational awareness of airport surface operations between the ATCT, the Ramp Tower, the TRACON facility, the Air Route Traffic Control Center (ARTCC) and the air carriers that operate at an airport, through the use of real-time position data and data link of key events.
- Several technologies will provide information that will improve shared situational awareness, including Automatic Dependent Surveillance - Broadcast (ADS-B) (w/ multi-

lateration), Airport Surface Detection Equipment (ASDE)-3, ASDE-X, Surface Movement Advisor (SMA), and Data Link Delivery of Taxi Clearance (DDTC).

- Interfaces to SMS may include Center TRACON Automation System (CTAS), Enhanced Traffic Management System/ Collaborative Decision Making (ETMS/CDM) and surface sensor systems (e.g., ASDE-X, transponder multi-lateration).
- The availability of a robust surveillance data fusion capability is essential to provide complete and reliable real-time position and Out Off On In (OOOI) information to SMS.
- Fusion of ADS-B and multilateration position reporting with ASDE primary radar in ASDE-X: ADS-B will provide accurate down-link of GPS-based position reports for equipped aircraft and some vehicles. Multilateration will provide position reports for all aircraft and vehicles having tagged beacon transmitters. Traffic Information Service, Broadcast Mode (TIS-B) will provide equipped aircraft and ground vehicles fused position reports of all aircraft and vehicles, whether ADS-B equipped or not.
- The SMS concept is planned research from the National Aeronautics and Space Administration (NASA). We will be testing this capability in Memphis in 2003.
- Free-Flight Phase One (FFP1) SMA provides transitional capabilities that will ultimately be incorporated in SMS. SMA provides estimated landing times for flights currently in the terminal area, based on information from the local Automated Radar Terminal System (ARTS). This provides users (dispatchers, ramp controllers and other airline personnel) improved information on arrival times to improve gate turnaround and avoid conflicts with gate management. FFP1 SMA is located at the following TRACONs and provides data for the associated airports:

TRACON	Airport(s)
Atlanta	ATL
Chicago	ORD, MDW
Dallas/Fort Worth	DFW, DAL
Detroit	DTW
Minneapolis	MSP
New York	EWR, JFK, LGA and TEB
Philadelphia	PHL
St. Louis	STL

- SMS will provide decision-support tools to predict, plan, and advise surface aircraft movements and increase throughput and user flexibility using numerous data sources. SMS can provide controllers with a set of tools for tactical control and strategic planning of aircraft movements (arrivals and departures) on the surface while incorporating airline priorities.
- Aeronautical Data Link will provide digital text communication between equipped aircraft and ground facilities, for the handling of clearances and other standard messages.
- Technologies that will enhance situational awareness in the cockpit, such as Cockpit Display of Traffic Information (CDTI) are discussed in AD-7.

- DDTC is now being evaluated at DTW and IAD, and is a currently available commercial product.
- ASDE-X has planned deployment to 25 sites by 2007, with an additional 34 ADSE-3 sites being upgraded to equivalent functionality by 2009.
- Real-time data feed to AOC's and integration of real-time position information with decision support tools is planned prior to 2010.
- Other necessary surface technologies as referred to in the Surface Evolution Plan (FAA Safe Flight 21 Office/Runway Safety Office):
  - Surveillance Fusion Box
  - Vehicle Tracking
  - Runway Status Lights

Notes:

- Text on ADS-B adapted from *Draft Safe Flight 21 Ops Concept* by the RTCA SF-21 Steering Group Operations/Procedures Working Group, January 12, 2001.
- Information on all surface technologies obtained from *Surface Technology Roadmap, Presentation to Runway Incursion Joint Safety Implementation Team (JSIT)*, presented by David Ford (AND-500), March 7, 2001.

Key Decisions

- Mandating ground vehicle equipage to provide or support surveillance.
- Aircraft and key ground vehicle equipage with CDTI is critical to providing full benefit of shared situational awareness to these aircraft and ground vehicles.
- Airport equipage of enabling technologies is critical to achieving the full benefit of SMS.
- ADS-B safety assessments complete in September 2001.
- Vehicle equipage (Part 139): rulemaking necessary to mandate equipage for all surface vehicles.
- Determination after analysis in 2003 Memphis trial on need for Local Area Augmentation System for surface surveillance accuracy requirements.

Key Risks

- Definition of SMS concept and requirements based on ongoing NASA research.
- Completion of NASA demonstration at Memphis in 2003.
- RTCA and international standards for surveillance data and avionics interfaces and protocols are on the critical path for scheduling.
- Deployment schedule for ASDE-X.
- Operational concept validation in Safe Flight 21.
- Development and deployment of cockpit technologies.